

### **REMARKS**

Claims 1 and 8 have been amended. Support for the amendments can be found throughout the specification and claims as originally filed, e.g., in original claim 10. No new matter has been added.

Claims 4 and 10 have been cancelled without prejudice or disclaimer of the subject matter thereof. Claims 1-3, 5, 7-9, 58, 60, 66-67 and 69 are presently in the application and are under examination.

#### **Rejection of claims under 35 USC §102(b) and/or §103(a)**

Claims 1-5, 7-10, 58, 60, 66-67 and 69 stand rejected under 35 USC §102(b) as anticipated by, or, in the alternative, obvious under 35 USC §103(a) over Takahashi, EP1159995 ("Takahashi"). The Examiner stated that "[t]he claims are considered to read on Takahashi . . . [I]f a difference exists between the [present] claims and Takahashi . . . it would reside in optimizing the elements of Takahashi." Office Action at page 2. The cancellation of claims 4 and 10 has obviated any rejection of those claims. As to the remaining claims, these statements are traversed.

First, Applicants reiterate the discussion of the cited reference presented with the papers filed previously, e.g., July 3, 2009. As Applicants understand the reference, Takahashi discloses certain materials having a hydrophobic moiety and an ion exchange moiety (see, e.g., paragraph [0001] of Takahashi). Ion exchange groups according to Takahashi include anion exchangers such as quaternary ammonium groups, primary amino groups, secondary amino groups, tertiary amino groups, and a mixture of primary and secondary amino groups, with quaternary amines being preferred (see, e.g., Takahashi at paragraph [0033]). However, the only amines exemplified in Takahashi are quaternized tertiary amines (see, e.g., paragraphs [0036] and [0054] of Takahashi). Takahashi does not teach or suggest a porous material comprising a copolymer of at least one hydrophobic monomer and at least one hydrophilic monomer, wherein the copolymer further comprises at least one ion-

exchange functional moiety selected from the group consisting of a cyclic tertiary amine and a substituted cyclic amine, much less a piperazinyl moiety, as required by present claim 1, as amended.

Although the Examiner has stated that Takahashi discloses “N-vinyl-2-pyrrolidone [which] is considered to be a recited amine,” Office Action at page 8, Applicants cannot agree. As discussed previously, N-vinyl-2-pyrrolidone is a cyclic amide or lactam, not an amine as required by the pending claims. Amides are clearly distinct from amines and have different chemical properties. Compare the definition of amine (“Amines are organic derivatives of ammonia,  $\text{NH}_3$ , in which one or more of the hydrogen atoms is replaced by an organyl group (a substituent having a single bond from a carbon atom)”) (accessed at <http://www.britannica.com/eb/article-79756/chemical-compound>) with the definition of amide (“Any member of either of two classes of nitrogen-containing organic compounds related to ammonia and amines and *containing a carbonyl group* ( $-\text{C}=\text{O}$ )”) (at <http://www.britannica.com/ebc/article-9355205>; emphasis supplied).

Although the Office Action contends that N-vinyl-2-pyrrolidone “is a tertiary amine because three of the hydrogen atoms from ammonia have been substituted,” this is simply not consistent with the usage of the term “amine” in the art, as evidenced by, e.g., the definitions provided above, which distinguish between nitrogen derivatives “in which one or more of the hydrogen atoms is replaced by an organyl group (a substituent having a single bond from a carbon atom)” (i.e., an amine) and nitrogen derivatives “related to ammonia and amines and *containing a carbonyl group* ( $-\text{C}=\text{O}$ )” (i.e., an amide). The Office Action provides no support at all for the statement that “amides are amines” – which, as discussed above, is simply incorrect – and Applicants request that the Examiner provide specific support for this statement if the rejection is to be maintained. Applicants contend that Takahashi discloses N-vinyl-2-pyrrolidone as a monomeric unit for polymerization, not as an ion-exchange functionality. In fact, Applicants submit that the N-vinyl-2-pyrrolidone moiety (or its residue in a polymer or copolymer) would not serve as an effective ion-exchange functionality at most relevant pH ranges, because the amido nitrogen of the pyrrolidone ring would not be protonated.

In addition, the pending claims are directed to a porous material comprising a copolymer of at least one hydrophobic monomer and at least one hydrophilic monomer. The copolymer further comprises at least one ion-exchange functional moiety comprises a piperazinyl moiety. Further, the hydrophilic monomer is N-vinylpyrrolidone.

Takahashi does not teach or suggest a such a porous material. While Takahashi discloses N-vinyl-2-pyrrolidone as a monomeric unit for polymerization (but not as an ion-exchange functionality), there is no teaching or suggestion in Takahashi of a copolymer of at least one hydrophobic monomer and at least one hydrophilic monomer, wherein said copolymer further comprises at least one ion-exchange functional moiety comprising a piperazinyl moiety, and wherein said hydrophilic monomer is N-vinylpyrrolidone.

Therefore, Applicants urge that Takahashi cannot anticipate, nor render obvious, the pending claims.

Claims 1-5, 7-10, 58, 60, 66-67 and 69 stand rejected as obvious under 35 USC §103(a) over Takahashi, EP1159995 ("Takahashi") in view of Greer (U.S. Patent No. 2,801,224) or Gilwood (U.S. Patent No. 2,824,844). The Examiner stated that "[a]t best, the claims differ from Takahashi . . . in reciting use of cyclic tertiary amines or substituted cyclic amines." Office Action at page 2. These statements are traversed.

The teachings of Takahashi have been described above. The Examiner has cited Gilwood as allegedly teaching a "tertiary amine and also his cyclic amine . . . provide excellent anion exchanging groups." Applicants reiterate the discussion of the cited reference(s) presented with the papers filed, e.g., October 31, 2007, May 19, 2008, and July 3, 2009. As Applicants understand the reference, the Gilwood patent teaches that quaternary ammonium derivatives (Col. 5, lines 14-18) and polyalkylene polyamines (primary amines, Col. 5, lines 22-26) are preferred. According to Gilwood, among secondary amines, dimethylamine is preferred (Col. 5, lines 34-35). Thus, Gilwood teaches away from selecting a cyclic tertiary amine or substituted cyclic amine of the previously-pending claims, and does not teach or suggest an ion-exchange functional group comprising a piperazinyl moiety.

The Examiner has also cited Greer as disclosing "piperazine and morpholine". However, as Applicants understand the reference, Greer is directed to the preparation

of resins containing a quaternary ammonium group or groups. To the extent that non-quaternary amines are disclosed, these appear to be used only as synthetic intermediates in the preparation of quaternary ammonium groups. Applicants note that Greer, at Col. 1, lines 38-43 (cited by the Examiner) does not discuss tertiary or cyclic amines and at col. 3, lines 2-12 (also cited by the Examiner), Greer discusses quaternized compounds, not tertiary or cyclic amines. Greer does not teach or suggest a porous material comprising a copolymer of at least one hydrophobic monomer and at least one hydrophilic monomer, wherein said copolymer further comprises at least one ion-exchange functional moiety comprising a piperaziny moiety, as claimed in pending claim 1. One of ordinary skill in the art would not be motivated to combine an intermediate of Greer with either Gilwood or Takahashi to arrive at the presently-claimed subject matter.

In view of the differences between Takahashi, Greer and Gilwood, and the differences between each of the cited references and the pending claims, Applicants respectfully contend that one of ordinary skill in the art would not have been motivated to combine the teachings of the references as suggested by the Examiner. Neither Takahashi, nor Greer, nor Gilwood, alone or in combination, teaches or suggests the claimed combination of (i) at least one hydrophobic monomer, (ii) at least one hydrophilic monomer, (iii) wherein said copolymer further comprises at least one ion-exchange functional moiety comprising a piperaziny moiety, and (iv) wherein said hydrophilic monomer is N-vinylpyrrolidone.

Applicants further submit that there would have been no reasonable expectation of success in making such a combination. Applicants further contend that the cited references, whether considered alone or in combination, do not render obvious the invention of the pending claims.

Claim 4 was rejected under 35 USC §103(a) as being unpatentable over Takahashi, EP1159995 alone, or Takahashi in view of either Greer or Gilwood, and further in view of Hofstee, U.S. Patent No. 4,000,098 ("Hofstee") and Unger, Chromatographic Science Series 47:585-720 (1990) ("Unger"). As Applicants understand the reference, Hofstee discloses matrices useful for hydrophobic interaction chromatography. While the Examiner points to Col. 3, lines 38-64 of Hofstee, Applicants note that this section contains no teaching of the use of an amine comprising

a piperazinyl moiety in a chromatographic matrix (note that benzylamine, cited by the Examiner, is not a cyclic amine). As Applicants understand the reference, the Unger reference is a review.

While Applicants do not agree with the rejection of claim 4, the cancellation of claim 4 has rendered moot this rejection.

Claims 8-10 stand rejected under 35 USC §103(a) as being unpatentable over Takahashi alone or in view of Greer or Gilwood, and further in view of Unger. The Examiner stated that "[i]t would have been obvious to react with a haloalkyl in Takahashi . . . in view of either [Greer or Gilwood] because Unger discloses chloromethylating a polymer and reaction with ammonia, a primary amine, or a secondary amine is one way of forming an anion exchanger." Office Action at pages 4-5 (citations omitted). These statements are traversed.

The teachings of Takahashi, Greer, Gilwood and Unger are discussed above. Neither Takahashi, Greer, Gilwood, nor Unger discloses a porous particle comprising a copolymer of at least one hydrophobic monomer and at least one hydrophilic monomer, wherein the hydrophilic monomer is N-vinylpyrrolidone, and wherein the copolymer further comprises at least one ion-exchange functional moiety comprising a piperazinyl moiety, and wherein the hydrophobic monomer is substituted by at least one haloalkyl group, and the ion-exchange functional is formed by reaction of the haloalkyl group with an amine comprising a piperazine ring, as required by pending claim 8 (as amended), and claim 9 which depends therefrom. Applicants therefore urge that claims 8-9 are not obvious over Takahashi, Greer, Gilwood, or Unger, whether taken alone or in combination.

Claims 1-5, 7-10, 58, 60, 66, 67 and 69 stand rejected under 35 USC §103(a) as being unpatentable over each of Lee, U.S. Patent No. 6,322,695 ("the '695 patent"), Lee (WO99/64480), in view of either Greer or Gilwood. The Examiner stated that "[i]t would have been obvious to use cyclic tertiary amines or substituted cyclic amines in each of Lee [the '695 patent] or Lee (WO 99/64480) either because Greer discloses [a] cyclic tertiary amine . . . or because Gilwood discloses [a tertiary amine] and [a] cyclic amine substituted with an electron withdrawing chlorine." Office Action at page 6 (some citations omitted). These statements are traversed.



It is noted that the two Lee references appear to be identical in disclosure, and they will therefore be addressed together (hereinafter "the Lee references") unless otherwise noted<sup>1</sup>. The Lee references disclose copolymers functionalized with an ion-exchange functional group which can include certain amines; however, the structures of the "ion-exchange functional group" of the Lee references do not include non-quaternized (including tertiary) cyclic amines. Although the Lee references mention that the hydrophilic monomer backbone can comprise a heterocyclic group, including a nitrogen-containing heterocyclic group (see, e.g., the '695 patent at Col. 3, line 64 – Col. 4, line 3), the Lee references do not teach or suggest that the "ion-exchange functional group" includes a piperazinyl moiety, as required by the pending claims.

Applicants respectfully contend that, in view of the differences between Lee, Greer and Gilwood, and the differences between each of the cited references and the pending claims, Applicants respectfully contend that one of ordinary skill in the art would not have been motivated to combine the teachings of the references as suggested by the Examiner. As noted above, Applicants further submit that there would have been no reasonable expectation of success in making such a putative combination. Applicants further contend that the cited references, whether considered alone or in combination, do not render obvious the invention of the pending claims.

Claim 4 stands rejected under 35 USC §103(a) as being unpatentable over each of Lee, U.S. Patent No. 6,322,695 ("the '695 patent"), Lee (WO99/64480), in view of either Greer or Gilwood, and further in view of Hofstee and Unger. While Applicants do not agree, as noted above, the cancellation of claim 4 has rendered moot this rejection.

Claims 8-10 stand rejected under 35 USC §103(a) as being unpatentable over each of Lee, U.S. Patent No. 6,322,695 ("the '695 patent"), Lee (WO99/64480), in view of either Greer or Gilwood, and further in view of Unger. This rejection is traversed.

None of Lee, Greer, Gilwood, and Unger, alone or in combination, discloses a porous particle comprising a copolymer of at least one hydrophobic monomer and at least one hydrophilic monomer, wherein the hydrophilic monomer is N-vinylpyrrolidone, and wherein the copolymer further comprises at least one ion-exchange functional

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<sup>1</sup> Applicants note that the present application claims priority to the application that matured into the '695 patent, and that the '695 patent is co-owned with the present application. Applicants do not concede that either of the Lee references is prior art.

moiety, and wherein the hydrophobic monomer is substituted by at least one haloalkyl group, and the ion-exchange functional is formed by reaction of the haloalkyl group with an amine comprising a piperazine ring, as required by pending claim 8 (as amended), and claim 9 which depends therefrom. Applicants therefore urge that claims 8-9 are not obvious over Lee, Greer, Gilwood, or Unger, whether taken alone or in combination.

As discussed above, Applicants contend that the Office Action has not made out a *prima facie* case of obviousness of the present claims. However, even if a *prima facie* case of obviousness had been made, Applicants further contend that any such *prima facie* case of obviousness is rebutted by further evidence of non-obviousness, including the commercial success of chromatographic materials embodying the claimed materials. Applicants note that sales of such commercial materials have increased year-over-year and provide evidence of commercial success and/or long-felt need for the presently-claimed materials.

Reconsideration and withdrawal of the rejections under 35 USC §102(b) and/or §103(a) is proper and such action is respectfully requested.

#### Supplemental Information Disclosure Statement

The Examiner's attention is directed to the Supplemental Information Disclosure Statement (IDS) filed with this paper. Applicants request that the Examiner consider the references cited and return an initialed copy of the IDS to Applicants with the next Office Action or Notice of Allowance.

#### CONCLUSION

For at least the foregoing reasons, reconsideration and withdrawal of all rejections is proper. Applicants submit that this application is in condition for allowance, and such action is requested.

If a telephone conversation with Applicants' attorney would help expedite the prosecution of the above-identified application, the Examiner is urged to call either of the undersigned representatives at (617) 239-0100.

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Applicants request any extension of time required for consideration of this paper. The Director is hereby authorized to charge all required fees and any deficiency in the fees filed, asserted to be filed or which should have been filed herewith to our Deposit Account No. 04-1105, under Order No. 60505CIP2(49991).

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Respectfully submitted,

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